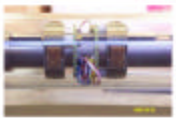
G. Annala, G. Ambrosio, P. Bauer, R. Carcagno, J. Carson, J. DiMarco, R.W. Hanft, D.J. Harding, R. Kephart, M.J. Lamm, M. Martens T. Peterson, P. Schlabach, C. Sylvester, M. Tartaglia, J.C. Tompkins, G. Velev



As part of the recent efforts to improve the Tevatron luminosity performance, Fermilab's Technical Division launched a magnetic measurement campaign in collaboration with the Tevatron department. This activity aims at resolving magnet related issues as well as to increase the luminosity in the Tevatron.

1) Inaccuracies in the b2 snapback compensation which can cause beam loss at the start of the ramp;
2) Strong coupling as a result of a skew quad component in the Tevatron dipoles introduced by a shift of the coils with respect to the yoke;
3) Tune and coupling drift which could originate from drifting quadrupole components in the magnets;
4) Drift and snapback in other, higher multipoles and in the main field which can cause differential chromaticity and energy errors;

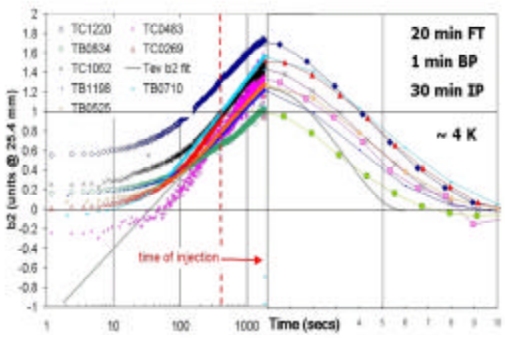



1) Analysis of the b2 Snapback Compensation

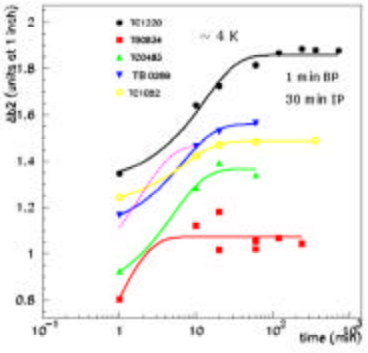
Imperfect control of the b2 drift and snapback in the superconducting magnets of the Tevatron can contribute to beam loss and emittance dilution during ramping from injection to collision. A thorough investigation of the Tevatron b2 correction was conducted, including magnetic measurements and beam based chromaticity measurements. The study allowed to improve the understanding of drift and snapback effects in superconducting magnets, which were actually discovered when the Tevatron was first operated. The magnetic measurements aimed at revealing the spread in the dynamic properties between different magnets and at understanding better the effects of the beam-less pre-cycle in the Tevatron on the dynamic properties. The pre-cycle parameters are front-porch, flat-top, back-porch and injection porch.

5 Proposals to improve the dynamic b2 compensation in the Tevatron:

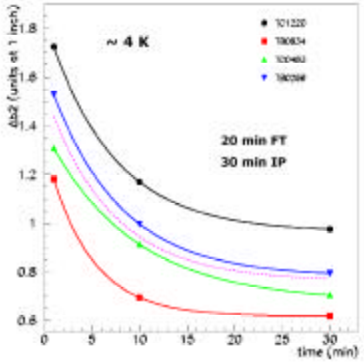
1) Fix (and extend) back-porch time;
2) Reduce # of beam-less pre-cycles following a Tevatron quench from 6 to 1 (but extend pre-cycle flat-top to a min of 40 min);
3) Change b2 SB fit to Gaussian function;
4) Saturation of flat-top duration effect on drift amplitude and absence of effect of front-porch duration allows elimination of the pre-cycle after intentionally terminated stores;
5) Improve drift fit – a double exponential appears to be slightly better than the log fit.



B2 drift and snapback in several recently measured Tevatron dipoles for a 1 min front-porch, a 20 min flat-top, 1 min back-porch and 30 min at injection. Note the magnet-to-magnet variations!



Effect of the flat-top duration on the b2 drift amplitude after 30 min on the injection porch. front-porch: 1 min, back-porch: 1min;



Effect of the back-porch duration on the b2 drift amplitude after 30 min on the injection porch. front-porch: 1 min, flat-top: 20 min;